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Exercise - I (Conceptual Questions) Build Up Your Understanding

ELASTICITY

1. The lower surface of a cube is fixed. On its upper surface, force is applied at an angle of 30° from its surface. The change will be in its
(1) shape
(2) size
(3) volume
(4) both shape and size

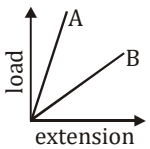
2. One end of uniform wire of length L and of weight W is attached rigidly to a point in the roof and a weight W_1 is suspended from its lower end. If s is the area of cross-section of the wire, the stress in the wire at a height (L/4) from its lower end is

(1) $\frac{W_1}{s}$ (2) $\frac{\left[W_1+\frac{W}{4}\right]}{s}$

(3) $\frac{\left[W_1+\frac{3W}{4}\right]}{s}$ (4) $\frac{W_1+W}{4}$

3. For steel, the breaking stress is 6×10^6 N/m^2 and the density is 8×10^3 kg/m^3. The maximum length of steel wire, which can be suspended without breaking under its own weight is [g = 10 m/s^2]
(1) 140 m (2) 120 m
(3) 75 m (4) 200 m

4. The dimensions of two wires A and B are the same. But their materials are different. Their load-extension graphs are shown. If Y_A and Y_B are the values of Young's modulus of elasticity of A and B respectively then



(1) $Y_A > Y_B$
(2) $Y_A < Y_B$
(3) $Y_A = Y_B$
(4) $Y_B = 2Y_A$

5. If the density of the material increase, the value of Young's modulus
(1) increases
(2) decreases
(3) first increases, then decreases
(4) first decreases, then increases

6. A fixed volume of iron is drawn into a wire of length ℓ. The extension produced in this wire by a constant force F is proportional to -
(1) $\frac{1}{\ell^2}$ (2) $\frac{1}{\ell}$ (3) ℓ^2 (4) ℓ

7. A wire elongates by ℓ mm when a load W is hanged from it. If the wire goes over a pulley and two weights W each are hung at the two ends, the elongation of the wire will be (in mm)-
(1) ℓ (2) 2ℓ (3) zero (4) $\ell/2$

8. The Young's modulus of a rubber string 8 cm long and density 1.5 kg/m^3 is 5×10^8 N/m^2, is suspended on the ceiling in a room. The increase in length due to its own weight will be :
(1) 9.6×10^{-5} m (2) 9.6×10^{-11} m
(3) 9.6×10^{-3} m (4) 9.6 m

9. A ball falling in a lake of depth 200 m shows 0.1% decrease in its volume at the bottom. What is the bulk modulus of the material of the ball :
(1) 19.6×10^8 N/m^2 (2) 19.6×10^{-10} N/m^2
(3) 19.6×10^{10} N/m^2 (4) 19.6×10^{-8} N/m^2

10. The pressure of a medium is changed from 1.01×10^5 Pa to 1.165×10^5 Pa and change in volume is 10% keeping temperature constant. The bulk modulus of the medium is :–
(1) 204.8×10^5 Pa (2) 102.4×10^5 Pa
(3) 51.2×10^5 Pa (4) 1.55×10^5 Pa

11. Two wires of the same material and length but diameters in the ratio 1 : 2 are stretched by the same force. The potential energy per unit volume for the two wires when stretched will be in the ratio.
(1) 16 : 1 (2) 4 : 1
(3) 2 : 1 (4) 1 : 1

12. A weight is suspended from a long metal wire. If the wire suddenly breaks, its temperature
(1) rises
(2) falls
(3) remains unchanged
(4) attains a value 0 K

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13. A mass of 0.5 kg is suspended from wire, then length of wire increase by 3 mm then find out work done :
(1) 4.5×10^{-3} J (2) 7.3×10^{-3} J
(3) 9.3×10^{-2} J (4) 2.5×10^{-2} J

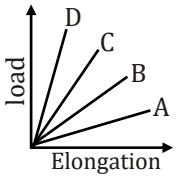
14. If the strain in a wire is not more than 1/1000 and Y = 2×10^{11} N/m^2, Diameter of wire is 1mm. The maximum weight hung from the wire is:-
(1) 110 N (2) 125 N
(3) 157 N (4) 168 N

15. When a tension F is applied in uniform wire of length ℓ and radius r, the elongation produced is e. When tension 2F is applied, the elongation produced in another uniform wire of length 2ℓ and radius 2r made of same material is :–
(1) 0.5 e (2) 1.0 e (3) 1.5 e (4) 2.0 e

16. How much force is required to produce an increase of 0.2% in the length of a brass wire of diameter 0.6 mm ?
[Young's modulus for brass = 0.9×10^{11} N/m^2]
(1) Nearly 17 N (2) Nearly 34 N
(3) Nearly 51 N (4) Nearly 68 N

17. If the interatomic spacing in a steel wire is 2.8×10^{-10} m and $Y_{steel} = 2 \times 10^{11}$ N/m^2, then force constant in N/m is –
(1) 5.6 (2) 56 (3) 0.56 (4) 560

18. The load versus elongation graph for four wires of the same material and same length is shown in the figure. The thinnest wire is represented by the line.



(1) OA
(2) OB
(3) OC
(4) OD

19. The mean distance between the atoms of iron is 3×10^{-10} m and inter atomic force constant for iron is 7 N/m. The young's modulus of elasticity for iron is :
(1) 2.33×10^5 N/m^2 (2) 23.3×10^{10} N/m^2
(3) 233×10^{10} N/m^2 (4) 2.33×10^{10} N/m^2

20. Cross section area of a steel wire (Y=2.0×10^{11} N/m^2) is 0.1 cm^2. The required force, to make its length double will be –
(1) 2×10^{12}N (2) 2×10^{11}N
(3) 2×10^{10}N (4) 2×10^{6}N

21. For a given material, the Young's modulus is 2.4 times that of rigidity modulus. Its Poisson's ratio is :
(1) 2.4 (2) 1.2 (3) 0.4 (4) 0.2

22. The diameter of a brass rod is 4 mm and Young's modulus of brass is 9×10^{10} N/m^2. The force required to stretch by 0.1% of its length is :
(1) 360π N (2) 36 N
(3) $144\pi \times 10^3$ N (4) $36\pi \times 10^5$ N

23. Poisson's ratio can not have the value :
(1) 0.1 (2) 0.7 (3) 0.2 (4) 0.5

24. Two wires of the same length and material but different radii r_1 and r_2 are suspended from a rigid support both carry the same load at the lower end. The ratio of the stress developed in the second wire to that developed in the first wire is –
(1) $\frac{r_1}{r_2}$ (2) $\frac{r_1^2}{r_2^2}$
(3) $\left(\frac{r_1}{r_2}\right)^{5/2}$ (4) $\left(\frac{r_1}{r_2}\right)^{1/2}$

25. An increases in pressure required to decreases the 200 litres volume of a liquid by 0.004% in container is :
(Bulk modulus of the liquid = 2100 MPa)
(1) 188 kPa (2) 8.4 kPa
(3) 18.8 kPa (4) 84 kPa

26. If 'S' is stress and 'Y' is Young's modulus of material of a wire, the energy stored in the wire per unit volume is
(1) $\frac{S}{2Y}$ (2) $\frac{2Y}{S^2}$
(3) $\frac{S^2}{2Y}$ (4) $2S^2Y$

27. For a constant hydraulic stress on an object, the fractional change in the object's volume $\left(\frac{\Delta V}{V}\right)$ and its bulk modulus (B) are related as :
(1) $\frac{\Delta V}{V} \propto B$ (2) $\frac{\Delta V}{V} \propto \frac{1}{B}$
(3) $\frac{\Delta V}{V} \propto B^2$ (4) $\frac{\Delta V}{V} \propto B^{-2}$

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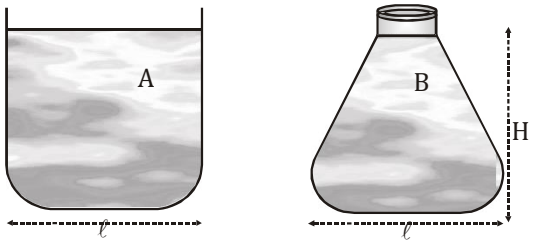
28. A wire of length L and cross-sectional area A is made of a material of Young's modulus Y. The work done in stretching the wire by an amount x is given by :-

(1) $\frac{YAx^2}{L}$ (2) $\frac{YAx^2}{2L}$

(3) $\frac{YAL^2}{x}$ (4) $\frac{YAL^2}{2x}$

FLUIDS STATICS

29. Two vessels A and B have the same base area and contain water to the same height, but the mass of water in A is four times that in B. The ratio of the liquid thrust at the base of A to that at the base of B is :-

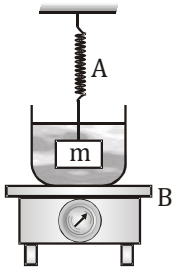


(1) 4 : 1 (2) 2 : 1 (3) 1 : 1 (4) 16 : 1

30. A cylinder is filled with a liquid of density d upto a height h. If the beaker is at rest, then the mean pressure on the wall is :-

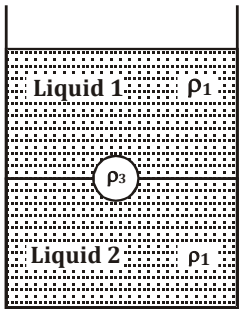
(1) Zero (2) hdg (3) $\frac{h}{2}$dg (4) 2 hdg

31. The spring balance A read 2 kg. with a block m suspended from it. A balance B reads 5 kg. when a beaker with liquid is put on the pan of the balance. The two balances are now so arranged that the hanging mass is inside the liquid in the beaker as shown in fig. In this situation :–



(1) The balance A will read more than 2 kg.
(2) The balance B will read more than 5 kg.
(3) The balance A will read less than 2 kg. and B will read more than 5 kg.
(4) The balance A and B will read 2 kg. and 5 kg. respectively.

32. A jar is filled with two non-mixing liquids 1 and 2 having densities and, respectively.



A solid ball, made of a material of density ρ_3, is dropped in the jar. It comes to equilibrium in the position shown in the figure. Which of the following is true for ρ_1, ρ_2 & ρ_3

(1) $\rho_3 < \rho_1 < \rho_2$ (2) $\rho_1 > \rho_3 > \rho_2$

(3) $\rho_1 < \rho_2 < \rho_3$ (4) $\rho_1 < \rho_3 < \rho_2$

33. A boat having a length of 3 metre and breadth 2 metre is floating on a lake. The boat sinks by one cm when a man gets on it. The mass of the man is

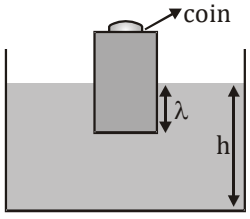
(1) 60 kg (2) 62 kg

(3) 72 kg (4) 128 kg

34. If the density of a block is 981 kg/m^3 then it shall

(1) Sink in water
(2) float with some part emmersed in water
(3) float completely immersed in water
(4) float completely out of water.

35. A wooden block, with a coin placed on its top, floats in water as shown in figure. The distance ℓ and h are shown there. After sometime the coin falls into the water. Then :–



(1) ℓ decreases and h increases
(2) ℓ increases and h decreases
(3) both ℓ and h increase
(4) both ℓ and h decrease

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36. A piece of ice is floating in a jar containing water. When the ice melts, then the level of water :-
(1) Rises
(2) Falls
(3) Remains unchanged
(4) Changes erratically

37. A sample of metal weights 210 gram in air, 180 gram in water and 120 gram in an unknown liquid. Then :-
(1) the density of metal is 3 g/cm^3
(2) the density of metal is 7 g/cm^3
(3) density of metal is 4 times the density of the unknown liquid
(4) the metal will float in water

38. 'Torr' is the unit of :-
(1) Pressure (2) Density
(3) Volume (4) Flux

39. A sphere is floating in water its 1/3rd part is outside the water and when sphere is floating in unknown liquid, its $\frac{3}{4}$th part is outside the liquid then density of liquid is
(1) 4/9 gm/c.c. (2) 9/4 gm/c.c.
(3) 8/3 gm/c.c. (4) 3/8 gm/c.c.

40. Which of the following works on Pascal's law ?
(1) Sprayer
(2) Venturimeter
(3) Hydraulic lift
(4) Aneroid barometer

41. An object of weight W and density is submerged in a fluid of density. Its appearent weight will be
(1) $W(\rho-\rho_1)$ (2) $\frac{(\rho-\rho_1)}{W}$
(3) $W\left(1-\frac{\rho_1}{\rho}\right)$ (4) $W(\rho_1-\rho)$

42. Which law states that the magnitude of pressure within fluid is equal in all parts ?
(1) Pascal's law (2) Gay-Lusac's law
(3) Dalton's law (4) Boyle's law

43. A body measures 5 N in air and 2 N when put in water. The buoyant force is
(1) 7 N (2) 9 N
(3) 3 N (4) None of these

44. Hydraulic press is based upon
(1) Archimede's principle
(2) Bernoulli's theorem
(3) Pascal's law
(4) Reynold's number

45. A wooden block is taken to the bottom of a lake of water and then released. it rise up with a
(1) Constant acceleration
(2) Decreasing acceleration
(3) Constant velocity
(4) Decreasing velocity

FLUIDS DYNAMICS

46. Two water pipes P and Q having diameter 2×10^{-2} m and 4×10^{-2} m respectively are joined in series with the main supply line of water. The velocity of water flowing in pipe P is
(1) 4 times that of Q
(2) 2 times that of Q
(3) $\frac{1}{2}$ times that of Q
(4) $\frac{1}{4}$ times that of Q

47. The cylindrical tube of a spray pump has a radius R, one end of which has n fine holes, each of radius r. If the speed of flow of the liquid in the tube is v, the speed of ejection of the liquid through the hole is :-
(1) $\frac{v}{n}\left(\frac{R}{r}\right)$ (2) $\frac{v}{n}\left(\frac{R}{r}\right)^{1/2}$
(3) $\frac{v}{n}\left(\frac{R}{r}\right)^{3/2}$ (4) $\frac{v}{n}\left(\frac{R}{r}\right)^{2}$

48. Water from a tap emerges vertically downwards with an initial speed of 1.0 m/s. The cross–sectional area of tap is 10^{-4} m^2. Assume that the pressure is constant throughout the stream of water and that the flow is steady, the cross–sectional area of stream 0.15 m below the tap is :–
(1) 5.0×10^{-4} m^2 (2) 1.0×10^{-4} m^2
(3) 5.0×10^{-5} m^2 (4) 2.0×10^{-5} m^2

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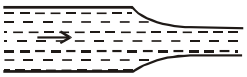
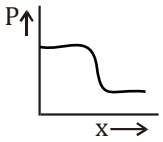
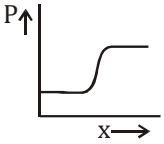
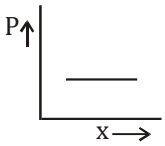
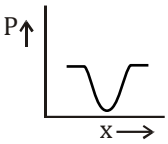
49. Water flows through a frictionless duct with a cross-section varying as shown in figure. Pressure P at points along the axis is represented by



(1) 

(2) 

(3) 

(4) 

50. A tank of height 5 m is full of water. There is a hole of cross sectional area 1 cm^2 in its bottom. The initial volume of water that will come out from this hole per second is

(1) $10^{-3}\ m^3/s$ (2) $10^{-4}\ m^3/s$

(3) $10\ m^3/s$ (4) $10^{-2}\ m^3/s$.

51. The pressure of water in a water pipe when tap is opened and closed is respectively 3×10^5 N/m^2 and 3.5×10^5 N/m^2. With open tap, the velocity of water flowing is

(1) 10 m/s (2) 5 m/s

(3) 20 m/s (4) 15 m/s

52. The flow speeds of air on the lower and upper surfaces of the wing of an aeroplane are v and $\sqrt{2}$ v respectively. The density of air is ρ and surface area of wing is A. The dynamic lift on the wing is :

(1) $\rho v^2 A$ (2) $\sqrt{2}\,\rho v^2 A$

(3) $(1/2)\,\rho v^2 A$ (4) $2\rho v^2 A$

53. An incompressible fluid flows steadily through a cylindrical pipe which has radius 2 R at point A and radius R at point B farther along the flow direction. If the velocity at point A is v, its velocity at point B is:-

(1) 2v (2) v (3) $\frac{v}{2}$ (4) 4v

54. Water is flowing through a non-uniform radius tube. If ratio of the radius of entry and exit end of the pipe is 3 : 2 then the ratio of velocities of entring and exit liquid is :-

(1) 4 : 9 (2) 9 : 4 (3) 8 : 27 (4) 1 : 1

55. An aeroplane of mass 3×10^4 kg and total wing area of 120 m^2 is in a level flight at some height. The difference in pressure between the upper and lower surfaces of its wings in kilopascals is ($g=10 m/s^2$)

(1) 2.5 (2) 5.0 (3) 10.0 (4) 12.5

56. Scent sprayer is based on

(1) Charle's law

(2) Archimede's principle

(3) Boyle's law

(4) Bernoulli's theorem

57. Bernoulli's equation for steady, non-viscous, in-compressible flow expresses the

(1) Conservation of angular momentum

(2) Conservation of density

(3) Conservation of momentum

(4) Conservation of mechanical energy.

58. Application of Bernoulli's theorem can be seen in

(1) Dynamic lift to aeroplane

(2) Hydraulic press

(3) Speed Boat

(4) None of these

59. The velocity of water flowing in a non-uniform tube is 20 cm/s at a point where the tube radius is 0.2 cm. The velocity at another point, where the radius is 0.1 cm is

(1) 80cm/s (2) 40cm/s

(3) 20cm/s (4) 5cm/s

VISCOSITY

60. A small drop of water falls from rest through a large height h in air. The final velocity is

(1) almost independent of h

(2) proportional to $\sqrt{h}$

(3) proportional to h

(4) inversely proportional to h

61. Two drops of equal radius are falling through air with a steady velocity of 5 cm/s. If the two drops coalesce, then its terminal velocity will be –

(1) $4^{1/3} \times 5 cm/s$ (2) $4^{1/3}$ cm/s

(3) $5^{1/3} \times 4 cm/s$ (4) $4^{2/3} \times 5 cm/s$

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62. If the terminal speed of a sphere of gold (density = 19.5 kg/m^3) is 0.2 m/s in a viscous liquid (density = 1.5 kg/m^3), find the terminal speed of a sphere of silver (density=10.5 kg/m^3) of the same size in the same liquid.
(1) 0.4 m/s (2) 0.133 m/s
(3) 0.1 m/s (4) 0.2 m/s

63. Speed of 2 cm radius ball in a viscous liquid is 20 cm/s. Then the speed of 1 cm radius ball in the same liquid is
(1) 5 cm/s (2) 10 cm/s
(3) 40 cm/s (4) 80 cm/s

64. The velocity of falling rain drop attain limited value because of
(1) surface tension
(2) upthrust due to air
(3) viscous force exerted by air
(4) air current

65. Poise is the unit of
(1) Pressure (2) Friction
(3) Surface tension (4) Viscosity

66. Two rain drops falling through air have radii in the ratio 1:2. They will have terminal velocity in the ratio.
(1) 4 : 1 (2) 1 : 4 (3) 2 : 1 (4) 1 : 2

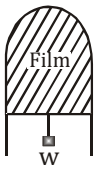
67. A sphere of mass M and radius R is falling in a viscous fluid. The terminal velocity attained by the falling object will be proportional to
(1) MR^2 (2) M/R
(3) MR (4) M/R^2

68. A drop of water of radius 0.0015 mm is falling in air. If the coefficient of viscosity of air is 2.0×10^{-5} kg / (m-s), the terminal velocity of the drop will be (The density of water = 1.0×10^3 kg/m^3 and g = 10 m/s^2)
(1) 1.0×10^{-4} m/s (2) 2.0×10^{-4} m/s
(3) 2.5×10^{-4} m/s (4) 5.0×10^{-4} m/s

SURFACE TENSION

69. Spiders and insects move and run about on the surface of water without sinking because :
(1) Elastic membrane is formed on water due to propery of surface tension
(2) Spiders and insects are ligther
(3) Spiders and insects swim on water
(4) Spiders and insects experience up-thrust

70. A thin liquid film formed between a U-shaped wire and a light slider supports a weight of 1.5×10^{-2} N (see figure). The length of the slider is 30 cm and its weight negligible. The surface tension of the liquid film is :-
(1) 0.025 N/m
(2) 0.0125 N/m
(3) 0.1 N/m
(4) 0.05 N/m



71. A liquid drop of diameter D breaks into 27 tiny drops. The resultant change in energy is –
(1) 2π TD^2 (2) 4π TD^2
(3) π TD^2 (4) None of these

72. The excess pressure inside an air bubble of radius r just below the surface of water is p_1. The excess pressure inside a drop of the same radius just outside the surface is p_2. If T is surface tension, then
(1) $p_1 = 2p_2$ (2) $p_1 = p_2$
(3) $p_2 = 2p_1$ (4) $p_2 = 0, p_1 \neq 0$

73. A water drop is divided into 8 equal droplets. The pressure difference between inner and outer sides of the big drop
(1) will be the same as for smaller droplet
(2) will be half of that for smaller droplet
(3) will be one-forth of that for smaller droplet
(4) will be twice of that for smaller droplet.

74. A false statement is :
(1) Angle of contact $\theta < 90°$, if cohesive force < adhesive force $\times \sqrt{2}$
(2) Angle of contact $\theta > 90°$, if cohesive force > adhesive force $\times \sqrt{2}$
(3) Angle of contact $\theta = 90°$, if cohesive force = adhesive force $\times \sqrt{2}$
(4) If the radius of capillary is reduced to half, the rise of liquid column becomes four times

75. If a capillary of radius r is dipped in water, the height of water that rises in it is h and its mass is M. If the radius of the capillary is doubled the mass of water that rises in the capillary will be
(1) 4M (2) 2M (3) M (4) $\frac{M}{2}$

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76. On dipping a capillary of radius 'r' in water, water rises upto a height H and potential energy of water is u_1. If a capillary of radius 2r is dipped in water, then the potential energy is u_2. The ratio $\frac{u_1}{u_2}$ is

(1) 2 : 1 (2) 1 : 2 (3) 4 : 1 (4) 1 : 1

77. A vessel, whose bottom has round holes with diameter of 0.1 mm, is filled with water. The maximum height to which the water can be filled without leakage is :–
(S.T. of water = 75 dyne/cm, g = 1000 cm/s^2)
(1) 100 cm (2) 75 cm
(3) 50 cm (4) 30 cm

78. In a surface tension experiment with a capillary tube water rises up to 0.1 m. If the same experiment is repeated on an artificial satellite which is revolving round the earth, water will rise in the capillary tube up to a height of
(1) 0.1 m
(2) 0.98 m
(3) 9.8 m
(4) full length of capillary tube

79. A soap bubble in vacuum has a radius of 3 cm and another soap bubble in vacuum has a radius of 4 cm. If the two bubbles coalesce under isothermal condition, then the radius of the new bubble is :
(1) 2.3 cm (2) 4.5 cm (3) 5 cm (4) 7 cm

80. The spherical shape of rain-drop is due to
(1) Density of the liquid
(2) Surface tension
(3) Atmospheric pressure
(4) Gravity

81. In a capillary tube, water rises by 1.2 mm. The height of water that will rise in another capillary tube having half the radius of the first, is :
(1) 1.2 mm (2) 2.4 mm
(3) 0.6 mm (4) 0.4 mm

82. Water rises to a height h in a capillary at the surface of earth. On the surface of the moon the height of water columm in the same capillary will be :
(1) 6h (2) 1/6 h
(3) h (4) Zero

83. Shape of meniscus for a liquid of zero angle of contact is -
(1) plane (2) parabolic
(3) hemi-spherical (4) cylindrical

84. Due to capillary action a liquid will rise in a tube if angle of contact is
(1) acute (2) obtuse
(3) 90° (4) 180°

85. Two droplets merge with each other and form a large droplet. In this process :
(1) Energy is liberated
(2) Energy is absorbed
(3) Neither liberated nor absorbed
(4) Some mass is converted into energy

86. Two capillary tubes of same diameter are put vertically one each in two liquids whose relative densities are 0.8 and 0.6 and surface tensions are 60 dyne/cm and 50 dyne/cm respectively. Ratio of heights of liquids in the two tubes h_1/h_2 is :
(1) $\frac{10}{9}$ (2) $\frac{3}{10}$ (3) $\frac{10}{3}$ (4) $\frac{9}{10}$

87. The property utilized in the manufacture of lead shots is :
(1) Specific weight of liquid lead
(2) Specific gravity of liquid lead
(3) Compressibility of liquid lead
(4) Surface tension of liquid lead

88. Surface tension of a liquid is 5 N/m. If its thin film is made in a ring of area 0.02 m^2, then its surface energy will be –
(1) 5×10^{-2} Joule (2) 2.5×10^{-2} Joule
(3) 3×10^{-1} Joule (4) 2×10^{-1} Joule

89. If one end of capilary tube is dipped into water then water rises up to 3cm. If the surface tension of water is 75×10^{-3} N/m then the diameter of capilary tube will be
(1) 0.1 mm (2) 0.5 mm
(3) 1 mm (4) 2 mm

90. If the surface tension of a liquid is T and its surface area is increased by A, then the surface energy of that surface will be increased by –
(1) AT (2) A/T
(3) A^2T (4) A^2T^2

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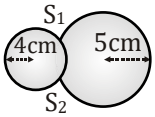
91. Two soap bubbles of radii r_1 and r_2 equal to 4cm and 5 cm are touching each other over a common surface S_1S_2 (shown in figure). Its radius will be :–



(1) 4 cm.
(2) 20 cm.
(3) 5 cm.
(4) 4.5 cm.

92. The radius of a soap bubble is r. The surface tension of soap solution is T. Keeping temperature constant, the radius of the soap bubble is doubled, the energy necessary for this will be

(1) $24\pi r^2 T$ (2) $8\pi r^2 T$
(3) $12\pi r^2 T$ (4) $16\pi r^2 T$

93. A liquid does not wet the sides of a solid, if the angle of contact is
(1) Zero
(2) Obtuse (more than 90°)
(3) Acute (less than 90°)
(4) 45°

94. The excess of pressure inside a soap bubble than that of the outer pressure is :

(1) $\frac{2T}{r}$ (2) $\frac{4T}{r}$ (3) $\frac{T}{2r}$ (4) $\frac{T}{r}$

95. In a capillary tube experiment, a vertical 30 cm long capillary tube is dipped in water. The water rises up to a height of 10 cm due to capillary action. If this experiment is conducted in a freely falling elevator, the length of the water column becomes :
(1) 10 cm (2) 20 cm (3) 30 cm (4) Zero

96. Radius of a capillary is 2×10^{-3} m. A liquid of weight 6.2×10^{-4} N may remain in the capillary. Then the surface tension of liquid will be :

(1) 5×10^{-3} N/m (2) 5×10^{-2} N/m
(3) 5 N/m (4) 50 N/m

97. A capillary tube of radius r can support a liquid of weight 6.28×10^{-4} N. If the surface tension of the liquid is 5×10^{-2} N/m. The radius of capillary must be :-

(1) 2×10^{-3} m (2) 2×10^{-4} m
(3) 1.5×10^{-3} (4) 12.5×10^{-4} m

98. Water rise in a capillary upto an extension height such that upward force of surface tension balances the force of 75×10^{-4} N. due to weight of water. If surface tension of water is 6×10^{-2} N/m. The internal circumference of the capillary must be :-

(1) 12.5×10^{-2} m (2) 6.5×10^{-2} m
(3) 0.5×10^{-2} m (4) 1.25×10^{-2} m

99. Two small drops of mercury, each of radius R, coalesce to form a single large drop. The ratio of the total surface energies before and after the change is :–

(1) $1 : 2^{1/3}$ (2) $2^{1/3} : 1$
(3) 2 : 1 (4) 1 : 2

100. Inside a drop excess pressure is maximum in :-
(1) 0.200 μm diameter
(2) 20.0 μm diameter
(3) 200 μm diameter
(4) 2.0 μm diameter

101. The diameter of one drop of water is 0.2 cm. The work done in breaking one drop into 1000 equal droplets will be :-
(surface tension of water = 7×10^{-2} N/m)

(1) 7.9×10^{-6} J (2) 5.92×10^{-6} J
(3) 2.92×10^{-6} J (4) 1.92×10^{-6} J

102. If two bubble of radii 0.03 cm and 0.04 cm come in contact with each other then the radius of curvature of the common surface 'r' is given by.

(1) 0.03 cm (2) 0.06 cm
(3) 0.12 cm (4) 0.24 cm

103. Work done in forming a soap bubble of radius R is W. Then work done is forming a soap bubble of radius '2R' will be :

(1) 2W (2) 4W (3) W/2 (3) W/4

104. At which angle liquid will not wet solid.

(1) Zero (2) acute
(3) 45° (4) obtuse

105. Internal radius of a capillary tube is $\frac{1}{28}$ cm and surface tension of water 70 dyne/cm, if angle of contact is zero, then water will rise up in the tube up to height.

(1) 4 cm (2) 2 cm
(3) 14 cm (4) 18 cm

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106. Area of liquid film is $6 \times 10\ cm^2$ and surface tension is T = 20 dyne/cm, what is the work done to change area up to $12 \times 10\ cm^2$:
(1) 120 joule (2) 120 erg
(3) 1200 joule (4) 2400 erg

107. The work done in blowing a soap bubble of radius 0.2 m, given that the surface tension of soap solution is 60×10^{-3} N/m, is
(1) $24\pi \times 10^{-4}$ J (2) $8\pi \times 10^{-4}$ J
(3) $96\pi \times 10^{-4}$ J (4) $192\pi \times 10^{-4}$ J

108. Adding detergents to water helps in removing dirty greasy stains. This is because
(a) It increases the oil-water surface tension
(b) It decreases the oil-water surface tension
(c) It increases the viscosity of the solution
(d) Dirt is held suspended surrounded by detergent molecules
(1) (b) and (d) (2) (a) only
(3) (c) and (d) (4) (d) only

109. The excess pressure inside a soap bubble A is twice that in another soap bubble B. The ratio of volumes of A and B is
(1) 1 : 2 (2) 1 : 4
(3) 1 : 8 (4) 1 : 16

110. Consider a soap film on a rectangular frame of wire of area $4\times 4\ cm^2$. If the area of the soap film is increased to $4 \times 5cm^2$, the work done in the process will be (The surface tension of the soap film is 3×10^{-2} N/m)
(1) 12×10^{-6} J (2) 24×10^{-6} J
(3) 60×10^{-6} J (4) 96×10^{-6} J

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	4	2	3	1	1	3	1	2	1	4	1	1	2	3	2
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	3	2	1	4	4	4	1	2	2	4	3	2	2	3	3
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	3	4	1	2	4	3	2	1	3	3	3	1	3	3	1
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	1	4	3	1	1	1	3	4	1	1	4	4	1	1	1
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	1	3	1	3	4	2	2	3	1	1	1	2	2	4	2
Question	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Answer	4	4	4	3	2	2	1	3	1	1	4	4	4	3	1
Question	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Answer	2	1	2	2	3	2	1	1	2	1	1	3	2	4	1
Question	106	107	108	109	110										
Answer	4	4	1	3	2										

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Exercise - II (Previous Year Questions) AIPMT/NEET

NEET UG 2013

1. The following four wires are made of the same material. Which of these will have the largest extension when the same tension is applied ?
(1) length = 300cm, diameter = 3mm
(2) length = 50 cm, diameter = 0.5 mm
(3) length = 100 cm, diameter = 1mm
(4) length = 200 cm, diameter = 2mm

2. The wettability of a surface by a liquid depends primarily on :-
(1) angle of contact between the surface and the liquid
(2) viscosity
(3) surface tension
(4) density

AIPMT 2014

3. Copper of fixed volume 'V; is drawn into wire of length 'ℓ'. When this wire is subjected to a constant force 'F', the extension produced in the wire is '$\Delta\ell$'. Which of the following graphs is a straight line ?
(1) $\Delta\ell$ versus $\frac{1}{\ell}$ (2) Δl versus ℓ^2
(3) $\Delta\ell$ versus $\frac{1}{\ell^2}$ (4) Δl versus ℓ

4. A certain number of spherical drops of a liquid of radius 'r' coalesce to form a single drop of radius 'R' and volume 'V'. If 'T' is the surface tension of the liquid, then :
(1) energy = $4VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released
(2) energy = $3VT\left(\frac{1}{r}+\frac{1}{R}\right)$ is absorbed
(3) energy = $3VT\left(\frac{1}{r}-\frac{1}{R}\right)$ is released
(4) Energy is neither released nor absorbed

AIPMT 2015

5. The approximate depth of an ocean is 2700 m. The compressibility of water is 45.4×10^{-11} Pa^{-1} and density of water is 10^3 kg/m^3. What fractional compression of water will be obtained at the bottom of the ocean ?
(1) 1.0×10^{-2} (2) 1.2×10^{-2}
(3) 1.4×10^{-2} (4) 0.8×10^{-2}

6. A wind with speed 40 m/s blows parallel to the roof of a house. The area of the roof is 250 m^2. Assuming that the pressure inside the house is atmospheric pressure, the force exerted by the wind on the roof and the direction of the force will be:
(ρ_{air} = 1.2 kg/m^3)
(1) 4.8×10^5 N, upwards
(2) 2.4×10^5 N, upwards
(3) 2.4×10^5 N, downwards
(4) 4.8×10^5 N, downwards

Re-AIPMT 2015

7. The cylindrical tube of a spray pump has radius R, one end of which has n fine holes, each of radius r. If the speed of the liquid in the tube is V, the speed of the ejection of the liquid through the holes is :-
(1) $\frac{V^2R}{nr}$ (2) $\frac{VR^2}{n^2r^2}$
(3) $\frac{VR^2}{nr^2}$ (4) $\frac{VR^2}{n^3r^2}$

8. The Young's modulus of steel is twice that of brass. Two wires of same length and of same area of cross section, one of steel and another of brass are suspended from the same roof. If we want the lower ends of the wires to be at the same level, then the weights added to the steel and brass wires must be in the ratio of :
(1) 1 : 1 (2) 1 : 2 (3) 2 : 1 (4) 4 : 1

9. Water rises to height 'h' in capillary tube. If the length of capillary tube above the surface of water is made less than 'h', then -
(1) water does not rise at all.
(2) water rises upto the tip of capillary tube and then starts overflowing like a fountain.
(3) water rises upto the top of capillary tube and stays there without overflowing.
(4) water rises upto a point a little below the top and stays there.

10. The heart of a man pumps 5 litres of blood through the arteries per minute at a pressure of 150 mm of mercury. If the density of mercury be 13.6×10^3 kg/m^3 and g = 10m/s^2 then the power of heart in watt is:
(1) 1.50 (2) 1.70
(3) 2.35 (4) 3.0

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NEET-I 2016

11. Two non-mixing liquids of densities ρ and nρ (n > 1) are put in a container. The height of each liquid is h. A solid cylinder of length L and density d is put in this container. The cylinder floats with its axis vertical and length pL(p < 1) in the denser liquid. The density d is equal to :-

(1) {1 + (n + 1)p}ρ (2) {2 + (n + 1)p}ρ
(3) {2 + (n – 1)p}ρ (4) {1 + (n – 1)p}ρ

NEET-II 2016

12. A rectangular film of liquid is extended from (4 cm × 2 cm) to (5 cm × 4 cm). If the work done is 3×10^{-4} J, the value of the surface tension of the liquid is :-

(1) 0.2 Nm^{-1} (2) 8.0 Nm^{-1}
(3) 0.250 Nm^{-1} (4) 0.125 Nm^{-1}

13. Three liquids of densities ρ_1, ρ_2 and ρ_3 (with $\rho_1 > \rho_2 > \rho_3$), having the same value of surface tension T, rise to the same height in three identical capillaries. The angles of contact θ_1, θ_2 and θ_3 obey:-

(1) $\frac{\pi}{2} < \theta_1 < \theta_2 < \theta_3 < \pi$

(2) $\pi > \theta_1 > \theta_2 > \theta_3 > \frac{\pi}{2}$

(3) $\frac{\pi}{2} > \theta_1 > \theta_2 > \theta_3 \geq 0$

(4) $0 \leq \theta_1 < \theta_2 < \theta_3 < \frac{\pi}{2}$

NEET(UG) 2017

14. The bulk modulus of a spherical object is 'B'. If it is subjected to uniform pressure 'p', the fractional decrease in radius is :-

(1) $\frac{B}{3p}$ (2) $\frac{3p}{B}$ (3) $\frac{p}{3B}$ (4) $\frac{p}{B}$

15. A U tube with both ends open to the atmosphere, is partially filled with water. Oil, which is immiscible with water, is poured into one side until it stands at a distance of 10 mm above the water level on the other side. Meanwhile the water rises by 65 mm from its original level (see diagram). The density of the oil is :-

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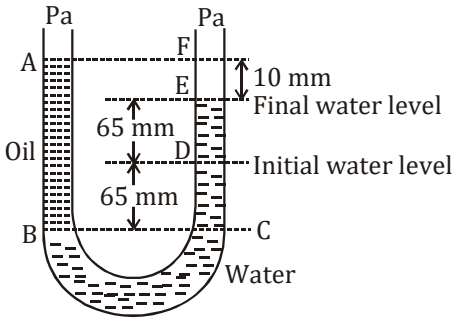


(1) 425 kg m^{-3} (2) 800 kg m^{-3}
(3) 928 kg m^{-3} (4) 650 kg m^{-3}

NEET(UG) 2018

16. A small sphere of radius 'r' falls from rest in a viscous liquid. As a result, heat is produced due to viscous force. The rate of production of heat when the sphere attains its terminal velocity, is proportional to :-

(1) r^3 (2) r^2 (3) r^5 (4) r^4

17. Two wires are made of the same material and have the same volume. The first wire has cross-sectional area A and the second wire has cross-sectional area 3A. If the length of the first wire is increased by Δl on applying a force F, how much force is needed to stretch the second wire by the same amount ?

(1) 9F (2) 6F (3) 4F (4) F

NEET(UG) 2019

18. A soap bubble, having radius of 1 mm, is blown from a detergent solution having a surface tension of 2.5×10^{-2} N/m. The pressure inside the bubble equals at a point Z_0 below the free surface of water in a container. Taking g = 10 m/s^2 density of water = 10^3 kg/m^3, the value of Z_0 is :-

(1) 100 cm (2) 10 cm
(3) 1 cm (4) 0.5 cm

19. When a block of mass M is suspended by a long wire of length L, the length of the wire become (L+*l*). The elastic potential energy stored in the extended wire is :-

(1) Mg*l* (2) MgL
(3) $\frac{1}{2}$ Mg*l* (4) $\frac{1}{2}$ MgL

20. A small hole of area of cross-section 2 mm^2 is present near the bottom of a fully filled open tank of height 2 m. Taking g = 10 m/s^2, the rate of flow of water through the open hole would be nearly :

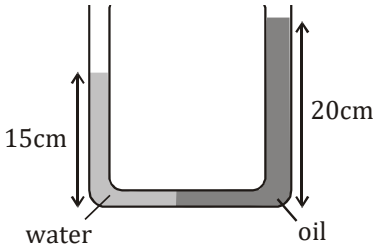
(1) 12.6×10^{-6} m^3/s (2) 8.9×10^{-6} m^3/s
(3) 2.23×10^{-6} m^3/s (4) 6.4×10^{-6} m^3/s

NEET(UG) 2019 (Odisha)

21. Two small spherical metal balls, having equal masses, are made from materials of densities ρ_1 and ρ_2($\rho_1 = 8\rho_2$) and have radii of 1mm and 2mm, respectively. They are made to fall vertically (from rest) in a viscous medium whose coefficient of viscosity equals η and whose density is 0.1 ρ_2. The ratio of their terminal velocities would be :-

(1) $\frac{79}{72}$ (2) $\frac{19}{36}$ (3) $\frac{39}{72}$ (4) $\frac{79}{36}$

22. In a U-tube as shown in figure, water and oil are in the left side and right side of the tube respectively. The heights from the bottom for water and oil columns are 15 cm and 20 cm respectively. The density of the oil is :-
[take ρ_{water} = 1000 kg/m^3]



(1) 1200 kg/m^3 (2) 750 kg/m^3
(3) 1000 kg/m^3 (4) 1333 kg/m^3

23. The stress-strain curves are drawn for two different materials X and Y. It is observed that the ultimate strength point and the fracture point are close to each other for material X but are far apart for material Y. We can say that materials X and Y are likely to be (respectively)

(1) ductile and brittle
(2) brittle and ductile
(3) brittle and plastic
(4) plastic and ductile

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NEET (UG) 2020

24. A capillary tube of radius r is immersed in water and water rises in it to a height h. The mass of the water in the capillary is 5g. Another capillary tube of radius 2r is immersed in water. The mass of water that will rise in this tube is :

(1) 20.0 g (2) 2.5 g
(3) 5.0 g (4) 10.0 g

25. A wire of length L, area of cross section A is hanging from a fixed support. The length of the wire changes to L_1 when mass M is suspended from its free end. The expression for Young's modulus is :

(1) $\frac{MgL}{A(L_1 - L)}$ (2) $\frac{MgL_1}{AL}$
(3) $\frac{Mg(L_1 - L)}{AL}$ (4) $\frac{MgL}{AL_1}$

NEET (UG) 2020 (Covid-19)

26. A liquid does not wet the solid surface if angle of contact is :

(1) equal to 45°
(2) equal to 60°
(3) greater than 90°
(4) zero

27. A barometer is constructed using a liquid (density = 760 kg/m^3). What would be the height of the liquid column, when a mercury barometer reads 76 cm ?
(density of mercury = 13600 kg/m^3)

(1) 1.36 m (2) 13.6 m
(3) 136 m (4) 0.76 m

NEET (UG) 2021

28. The velocity of a small ball of mass M and density d, when dropped in a container filled with glycerine becomes constant after some time. If the density of glycerine is $\frac{d}{2}$, then the viscous force acting on the ball will be :

(1) $\frac{Mg}{2}$ (2) Mg
(3) $\frac{3}{2}$Mg (4) 2Mg

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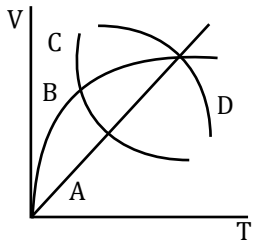
NEET (UG) 2022

29. A spherical ball is dropped in a long column of a highly viscous liquid. The curve in the graph shown, which represents the speed of the ball (v) as a function of time (t) is :



(1) B (2) C (3) D (4) A

30. If a soap bubble expands, the pressure inside the bubble :

(1) increases

(2) remains the same

(3) is equal to the atmospheric pressure

(4) decreases

RE-NEET (UG) 2022

31. Two copper vessels A and B have the same base area but of different shapes. A lakes twice the volume of water as that B requires to fill upto a particular common height. Then the correct statement among the following is:

(1) Pressure on the base area of vessels A and B is same.

(2) Pressure on the base area of vessels A and B is not same.

(3) Both vessels A and B weigh the same.

(4) Vessel B weighs twice that of A.

32. The terminal velocity of a copper ball of radius 5 mm falling through a tank of oil at room temperature is 10 cm s^{-1}. If the viscosity of oil at room temperature is 0.9 kg m^{-1} s^{-1}, the viscous drag force is :

(1) 8.48×10^{-3} N (2) 8.48×10^{-5} N

(3) 4.23×10^{-3} N (4) 4.23×10^{-6} N

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	1	2	3	2	2	3	3	3	2	4	4	4	3	3
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	3	1	3	3	1	4	2	2	4	1	3	2	1	1	4
Question	31	32													
Answer	1	1													

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Exercise - III (Analytical Questions) Master Your Understanding

1. Check the correctness of given statements :
Statement-I : Water wets glass capillary while mercury does not wet.
Statement-II : Excess pressure insides the soap bubble is inversely proportion to the radius of the bubble.
(1) Both statements are correct.
(2) Only statement-I is correct.
(3) Only statement-II is correct.
(4) Both statements are wrong.

2. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**
Assertion (A) : The shape of small liquid drop is spherical.
Reason (R) : Due to surface tension, liquid tends to occupy minimum surface area and for given volume a sphere has minimum surface area.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

3. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**
Assertion (A) : When an ice cube, floating in a glass of water melts, the water level remains unchanged.
Reason (R) : The volume of ice on melting decreases.
In the light of the above statements, choose the most appropriate answer from the options given below:
(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.
(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.
(3) **(A)** is true but **(R)** is false.
(4) **(A)** is false but **(R)** is true.

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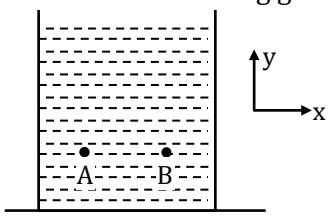
4. Match the column for followings

Column-A			Column-B	
i.	Bernoulli's theorem		A	$v=\sqrt{2gh}$
ii.	Law of continuity		B	$P+\frac{1}{2}\rho v^2+\rho gh$ = constant
iii.	Torricelli's theorem		C	$Q=\frac{\pi Pr^4}{8\eta\ell}$
iv.	Poiseuilli's theorem		D	Av = constant

(1) i → B, ii → D, iii → A, iv → C
(2) i → B, ii → A, iii → D, iv → C
(3) i → C, ii → D, iii → A, iv → B
(4) i → A, ii → B, iii → C, iv → D

5. A container filled with liquid is placed on a smooth surface. Two points A and B are in same level as shown, state about pressures at these points for following cases, in which container accelerates along given direction



Column-A		Column-B	
i.	$a_x = 0, a_y \neq 0$	A	$P_A = P_B$
ii.	$a_x = 0, a_y = 0$	B	$P_A > P_B$
iii.	$a_x > 0, a_y = 0$	C	$P_A < P_B$
iv.	$a_x > 0, a_y > 0$		

(1) i → B, ii → A, iii → A, iv → B
(2) i → A, ii → A, iii → B, iv → B
(3) i → A, ii → B, iii → A, iv → B
(4) i → B, ii → A, iii → B, iv → A

6. There is a small hole near the bottom of an open tank filled with a liquid. The speed of the water ejected does not depend on (one or more options may be correct)
(1) Area of the hole
(2) Density of the liquid
(3) Height of the liquid from the hole
(4) Acceleration due to gravity

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7. A solid floats in a liquid in a partially dipped position. (Select incorrect option)

(1) The solid exerts a force, equal to its weight on the liquid.

(2) The liquid exerts a force of buoyancy on the solid which is equal to the weight of the solid.

(3) The weight of the displaced liquid equals the weight of the solid.

(4) The weight of the dipped part of the solid is equal to the weight of the displaced liquid.

8. A copper wire ($Y = 10^{11}$ Nm^{-2}) of length 8m and steel wire ($Y = 2 \times 10^{11}$ Nm^{-2}) of length 4m and each of cross-sectional area 0.5 cm^2 are fastened end to end and stretched with a tension of 500 N. Match the given columns and select the correct option from the codes given below.

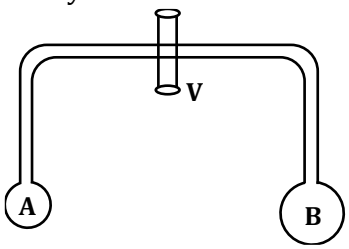
Column-I		Column-II	
(i)	Elongation in copper wire (in) mm)	(p)	0.2
(ii)	Elongation in steel wire (in mm)	(q)	1.0
(iii)	Total elongation (in mm)	(r)	0.8

Codes

(1) i – r, ii – p, iii – q (2) i – p, ii – q, iii – r

(3) i – q, ii – r, iii – p (4) i – p, ii – r, iii – p

9. The valve V in the bent tubes initially kept closed. Two soap bubbles A (smaller) and B (larger) are formed at the two open ends of the tube. Valve V is now opened and air can flow freely between the bubbles.



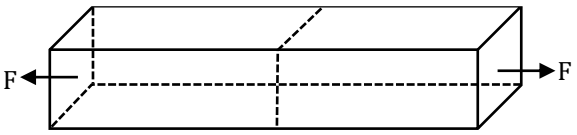
(1) There will be no change in the size of the bubbles

(2) The bubbles will becomes of equal size

(3) A will become smaller and B will become larger

(4) The sizes of A and B will be interchanged

10. In the figure shown, forces of equal magnitude are applied to the two ends of a uniform rod. Consider A as the cross-sectional area of the rod. For this situation, mark out the correct statement.



(1) The rod is in compressive stress

(2) The numerical value of stress developed in the rod is equal to F/A

(3) The stress is defined as internal restoring force per unit length

(4) None of the above

11. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : A needle placed carefully on the surface of water may float, whereas the ball of the same material will always sink.

Reason (R) : The buoyant force depends on the material and shape of body.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

12. Given below are two statements: One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Spraying of water in form of small droplets causes cooling.

Reason (R) : For an isolated system, surface energy increase on the expense of internal energy.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both **(A)** and **(R)** are true and **(R)** is the correct explanation of **(A)**.

(2) Both **(A)** and **(R)** are true and **(R)** is NOT the correct explanation of **(A)**.

(3) **(A)** is true but **(R)** is false.

(4) **(A)** is false but **(R)** is true.

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13. Given below are two statements :
Statement I : Viscosity of gases is greater than that of liquids.
Statement II : Surface tension of a liquid decreases due to the presence of insoluble impurities.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Both statement I and statement II are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements I and statements II are incorrect.

14. Given below are two statements :
Statement I : For a substance the product of bulk modulus of elasticity and compressibility is 1.
Statement II : The shear modulus for an ideal rigid body is infinite.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Both statement I and statement II are correct.
(2) Statement I is correct and statement II is incorrect.
(3) Statement I is incorrect and statement II is correct.
(4) Both statements I and statements II are incorrect.

15. Match the column:-

Column 1		Column 2	
(i)	For Concave meniscus	**(a)**	angle of contact > 90°
(ii)	For Convex meniscus	**(b)**	angle of contact = 90°
(iii)	For Plane meniscus	**(c)**	angle of contact < 90°

(1) (i) → (c); (ii) → (a); (iii) → (b)
(2) (i) → (a); (ii) → (b); (iii) → (c)
(3) (i) → (a); (ii) → (c); (iii) → (b)
(4) (i) → (b); (ii) → (a); (iii) → (c)

EXERCISE-III (Analytical Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	1	1	2	1	2	2	4	1	3	2	3	1	3	1	1

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